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ABSTRACT

The document presents the corporate and managerial policy results of quantitative models of an individual's propensity to terminate from manpower programs. The models were tested using a sample from 10 firms participating in the National Alliance of Businessmen (NABS) and the Job Opportunities in the Business Sector (JOBS) programs formed to identify, hire, and train unemployed members of the secondary labor market and to integrate them into the primary labor market. The withdrawal processes were studied using econometric simultaneous equation techniques along with multivariate statistical and probabilistic methods including reliability theory. A simultaneous model of turnover, retention, and absenteeism was developed, in order to investigate the hypothesized relationship between absenteeism and turnover. It includes the disaggregation of job satisfaction into a number of variables and also the introduction of supervisory variables. The study supports the assumption that turnover and attendance do not have identical determinants. Solely in terms of significance the findings show company policy variables to be the most important determinants of the propensity to terminate. The implications of the findings for hiring and supervisory policies relating to programs attempting to integrate disadvantaged workers are discussed at some length. A list of references is included and statistical data and analyses appended. (Author/EC)

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CORPORATE AND MANAGEMENT POLICIES FOR RECRUITMENT, EMPLOYMENT, TRAINING, AND RETENTION OF THE SECONDARY LABOR FORCE*

Wayne D. Perry

I. INTRODUCTION

This paper presents the corporate and managerial policy results of quantitative models of an individual's propensity to terminate from manpower programs. The models were tested empirically using a sample from ten firms in the Pittsburgh area that were in the National Alliance of Businessmen (NAB)-JOBS program. This alliance between the public and private sector was created to find, hire, and train unemployed members of the secondary labor force. Most of the urban poor and near poor belong to the secondary labor market. The NAB was formed early in 1968 under the aegis of President Lyndon Johnson and Henry Ford II as a non-profit corporation to solicit from private firms pledges to hire these secondary workers. Soon, the U.S. Department of Labor began the Job Opportunities in the Business Sector (JOBS) program as an incentive for employers to cooperate with the NAB. The JOBS contract offered government funds to firms for wages and extra services provided for hires when

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under training. Most firms cooperating with the NAB elected not to accept the government contract.

Table 1 illustrates the similarity in demographics between the local sample and those reported nationally from the JOBS program. Note especially the high percentage terminated. Many have argued that instability, high turnover, and associated attendance problems characterize the secondary labor market.[1] Hence, the motivation for the research was a desire to gain insight into these withdrawal problems associated with the further development of our national manpower policy.

The objectives of the policy in the NAB-JOBS program as I perceive them are:

(1) To develop methods of finding and hiring people who, because of educational, economic, or social deprivation and discrimination, would not normally qualify for employment in the primary labor market.

(2) To learn to design and implement programs on the local level that help to remedy these obstacles so that the secondary labor force can become more reliable, productive, and ultimately promotable employees.

The most prevalent complaints of firms with training programs that attempt to integrate these workers into the primary labor market are high turnover rates and frequency of absenteeism. Employee and trainee turnover and attendance have long been objects of extensive study in economics, management science, the behaviorial sciences and industrial relations research. However, in this paper these withdrawal processes are studied by methods that have not been used traditionally in the analysis of manpower problems. In particular, econometric simultaneous equation techniques are used along with other multivariate statistical and probabilistic methods (including reliability theory) to model some of the more complex aspects of turnover for both secondary workers and the firms' regular work force.

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[1] See Davis, Johnson, and Perry, 1973; Davis, et al., 1973; Doeringer and Piore, 1971; Ferman, 1968; Janger and Shaeffer, 1970; Schlensky, 1970; and Weber, Cassell, and Ginsberg, 1969.

Table 1

COMPARISON OF PERSONAL DATA OF THE LOCAL SAMPLE
WITH NATIONAL NAB-JOBS SAMPLE

Personal Characteristics	Local Sample n = 384	National Sample[a] n = 37,144
Sex (% male)	76.6	73.0
Age (average)	27.2	24.8
Race (% white)	21.0	21.0
Number of dependents (average including self)	3.2	3.6
Education (average grade)	10.8	10.5
Welfare recipient (%)	42.0	16.0
Weeks of unemployment (average in last year)	26.5	21.5
Income (average $ in last year)	2338.0	2432.0
Initial pay in program (average hourly wage $)	2.52 (5240/yr)[c]	2.10[b] (4888/yr)[c]
Termination (% including quits and fires)	51.0	52.0

[a]Letter prepared by A.R. Weber in "The JOBS Program," by the Subcommittee on Employment Manpower and Poverty of the Committee on Labor and Public Welfare, U.S. Senate, April 1970, pp. 176-177. (All characteristics include both the contract and non-contract programs through February 28, 1970).

[b]Janger and Shaeffer, 1970.

[c]Calculated assuming 8 hour day, 5 day work week, for 52 weeks.

II. MODELING THE SCREENING PROCESS

Personnel officers rather arbitrarily assign certain "desirable attributes" to predict the reliability of prospective employees. There have only been a few attempts to use a multivariate approach to determine the conditional probability of turnover in manpower programs, given the typical demographics used to screen persons for employment.[1] Of these few attempts, none may be adequate since typically a single equation linear regression model is applied with a binary dependent variable. My first need, therefore, was to develop a model to provide a better method of objectively ascertaining the significance of these "usual" screening variables.

There is no way to know exactly (in a deterministic sense) that a particular individual will leave given he has a certain p-vector of screening variables. This uncertainty leads one to be interested in the conditional probability of turnover given the individual has a group of these variables. The analysis assumed that an individual was either on board or terminated. Thus the dependent variable is binary.[2] If one proceeds in the usual manner to estimate this probabilistic event, with a sample of (N) individuals, the logistic model shown below can result.

LOGISTIC MODEL OF TURNOVER

$$y_i = \begin{cases} 1 & \text{terminated (voluntary or involuntary)} \\ 0 & \text{on board} \end{cases}$$

$$y_i = f(x_i', \theta) + \varepsilon_i \qquad i = 1,2\ldots,N \tag{1}$$

$$f(x_i', \theta) = [1 + \exp(-x_i', \theta')]^{-1} \tag{2}$$

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[1] See Davis et al., 1973; Greenberg, 1968; Schlensky, 1970.

[2] The justification for this simplification is the inherent ambiguities associated with distinguishing between quits and fires using cross-sectional data from a number of firms. There were also no drastic layoffs during the period (1968-1970) when the data were collected.

where

$$f(\underset{\sim}{x}_i', \underset{\sim}{\theta}) = P_i(y_i=1 \mid \underset{\sim}{x}_i) = E(y_i \mid \underset{\sim}{x}_i)$$

$$E(\varepsilon_i \mid \underset{\sim}{x}_i) = 0$$

$$\mathrm{Var}(\varepsilon_i) = P_i Q_i \qquad Q_i = 1 - P_i$$

$$E(\varepsilon_i, \varepsilon_j) = 0 \qquad i = j \qquad \forall\ i \text{ and } j$$

$\underset{\sim}{x}_i'$ = p-vector of screening variables for the ith individual

$\underset{\sim}{\theta}$ = p-vector of linear parameters.

The logistic functional form was chosen for $f(\underset{\sim}{x}_i, \underset{\sim}{\theta})$ since it adequately satisfied most of the statistical difficulties of estimating this binary event (Nerlove and Press, 1973). A nonlinear weighted least squares recursive numerical procedure was adopted that is identical to maximum liklihood estimation to calculate the parameters (Perry, 1975).

THE EFFECTS OF THE SCREENING VARIABLES ON TURNOVER

The conditional probability of turnover was estimated for the NAB-JOBS sample and regular new hires doing similar work by means of the logistic model. The independent screening variables (sex, education, race, age, etc.) are listed in Appendix A. The results are presented in Table A.1. As noted, the null hypothesis that the assumed set of screening variables accounts for no variance in the dependent variable--a constant probability of turnover for each individual--is rejected in all cases at the 1 percent level. From this analysis it appears that the JOBS trainees and the regular hires were selected from different populations. Thus, with the exception of race,[1] the significant screening variables for the JOBS hires had the opposite effect on the probability of turnover from the variables for the regular hires. The one attribute that most characterizes the probability that a JOBS hire will remain on board is the trainee's previous welfare status. If the JOBS hire were a welfare recipient just before employment, this significantly reduced his

[1] Whites had a significantly lower probability of turnover in either sample.

probability of turnover and accounted for more of its variance (see the Beta coefficients[1]) than any other variable. This attribute was not applicable for regular hires since none of them were recorded as welfare recipients just before employment. Another variable not applicable to the regular work force was the possession of a criminal record. However, having a criminal record was not important in estimating the likelihood of turnover for the JOBS hires. Comparison of the racial composition, mean educational level, length of unemployment, etc. between JOBS hires and regular hires supports the dual labor market hypothesis (see Table 2). These data reinforce the conclusion that on average the JOBS hires came from a different population. This empirical conclusion is also supported by the observations of the firms' personnel officers. An astute comment made by one of the program's trainers was that the JOBS hires represent a "new work force."

The analysis identified the importance of an individual's length of service to understanding the determinants of turnover and measuring turnover rates. The percentage of terminations usually decreases as a function of the employee's length of service. The significance and direction of the effects of most screening variables changed as a function of either sample's length of service. However, after one year's continuous service, there were fundamental changes in the model for both groups of workers. The only screening variable that was important for both groups after one year's service was age. Older workers had lower probabilities of turnover. Age was the only significant variable for regular hires; higher educational level and if the individual was or had been married also significantly reduced the probability of termination for the JOBS hire (Perry, 1975).

To understand the determinants of turnover and the measurement of turnover rates for secondary workers and for employees in general, one must control or account for the individual's length of service. The above results pose the fundamental question, does length of service

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[1] A method to obtain an indication of the relative importance of a given explanatory variable is to calculate the so-called "Beta" coefficients. These coefficients are found by multiplying the estimated logistic parameters by the ratio of the estimated variances of the relevant screening variable and the binary dependent variable.

Table 2

SUMMARY PERSONAL DATA FOR NAB-JOBS AND REGULAR EMPLOYEES

	Total NAB-JOBS Hires		Total Regular Hires	
Sample Size	(1) 384		(2) 165	
Percent Terminations[a]	51.3		27.9	
Screening Variables	Mean	Standard Deviation	Mean	Standard Deviation
Sex (% male)	76.6	N.A.[b]	75.8	N.A.
Age[a]	27.2	8.4	25.5	9.0
Race[a] (% white)	20.6	N.A.	82.4	N.A.
Married (%)	45.3	N.A.	37.6	N.A.
Marital breakup[a] (%)	16.2	N.A.	5.5	N.A.
Dependents[a]	3.2	2.1	1.8	1.3
School grade[a]	10.8	1.4	11.9	1.1
Weeks unemployed[a]	26.5	18.5	7.0	4.6
Distance from work[a] (Mi)	6.1	3.7	5.0	2.7
Initial hourly wage ($)	2.52	0.47	2.46	0.47

[a]The difference between the means in column (1) and column (2) is significant (at least) at the 5 percent level.

[b]In the case of these binary variables or states, a binomial distribution was assumed and the estimated variance is

$$\text{Var}(\bar{y}) = \bar{y}(1-\bar{y})$$

where $\bar{y}$ = mean.

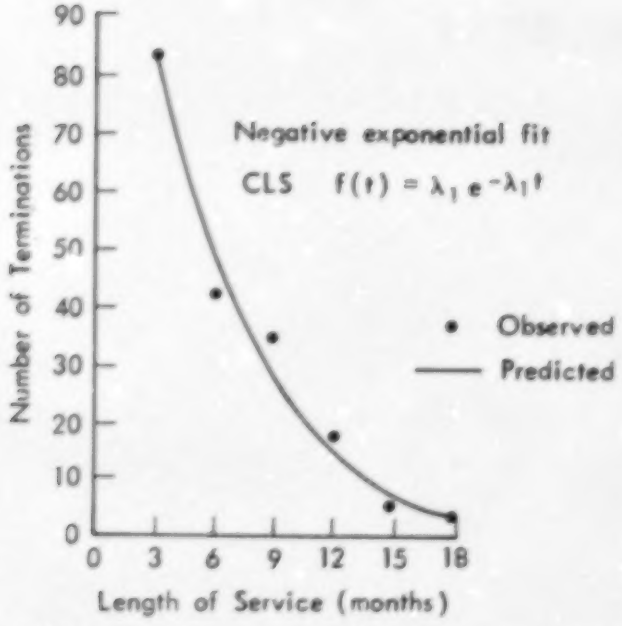
in the primary labor market actually transform individuals from the secondary market into more stable employees or is the reduction in group turnover rates with increasing length of service a result of a natural filtering or selection process inherent in any organization?

III. TURNOVER AS THE OUTCOME OF A STOCHASTIC PROCESS

Terminating was next viewed as the outcome of a stochastic process to account for length of service and to measure group turnover rates accurately. The measurement of labor turnover is not as straightforward as may first appear. The crude measure of turnover most often used by personnel officers is merely the ratio of the number of leavers in a given period to the average number employed for that period. This ratio can be entirely misleading, since its value depends heavily on the length of service of a group of employees or the age of an organization. Consequently, a new labor force, an organization that was created recently, or one that is expanding can be expected *a priori* to have a higher turnover rate than one that has been long established. This relationship will be true even if the new work force or the organization is *inherently* stable. To eliminate this problem the measurement of turnover rates should depend only on the propensity to leave--say, some completed length of service (CLS) probability distribution (Bartholomew, 1973).

The program was initially modeled as an organization of constant size, and turnover was viewed as the outcome of a self-renewing aggregate process to which renewal theory was applied. The negative exponential CLS distribution was judged to be a satisfactory description of the graduation of the number of leavers over time. This model indicated that there were no significant differences between the expected length of service and the theoretically predicted turnover rates for either the JOBS hires or regular hires (see Figs. 1 and 2).

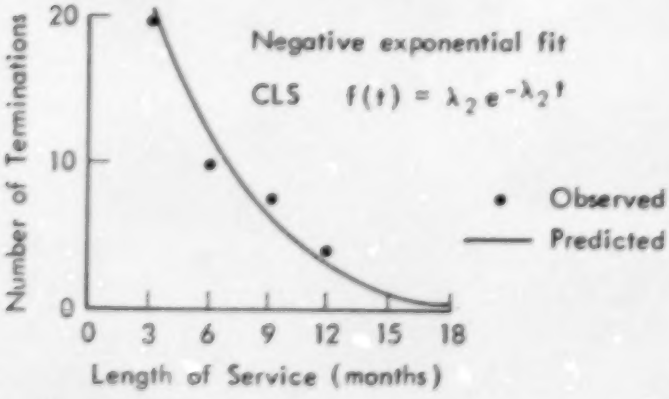
Just because turnover is modeled as the outcome of a renewal process does not guarantee a "good" estimate of the turnover rates. The fundamental error in using the latter model was the assumption that



MEAN $\hat{\mu}_1 = 5.25$ months (expected length of service)*

$\hat{\lambda}_1 = 0.190$

Fig. 1—Total NAB-JOBS sample (terminations vs. tenure)



MEAN $\hat{\mu}_2 = 5.08$ months (expected length of service)*

$\hat{\lambda}_2 = 0.197$

Fig. 2—Regular hires sample (terminations vs. tenure)

*The means are not significantly different at the 5 percent level

all firms began employing the JOBS hires at the same time. In fact, there is a 15-month interval between when the first and the last of the firms began their programs (see Fig. 3). Thus, a better approximation of the ten firm system is to assume an expanding organization in a step function manner. The resulting model of the expected number of terminations is given by eq. 3.

TURNOVER IN AN EXPANDING PROGRAM

$$\bar{L}_0(T) = N_0 \int_0^T h(t)dt \qquad (0 < T \leq T_1)$$

$$\bar{L}_1(T) = N_0 \int_0^T h(t)dt + N_1 \int_0^{T-T_1} h(t)dt \qquad (T_1 < T \leq T_2)$$

$$\vdots$$

$$\bar{L}_n(T) = N_0 \int_0^T h(t)dt + N_1 \int_0^{T-T_1} h(t)dt + \ldots + N_{n-1} \int_0^{T-T_{n-1}} h(t)dt + N_n \int_0^{T-T_n} h(t)dt \qquad (T_{n-1} < T \leq T_n) \qquad (3)$$

where

$L(T)$ = expected number of terminations at time T

N_0 initial number of hires at T_0

N_1 number of hires at T_1

$\vdots$ $\vdots$

N_n " " " " T_n

and $h(t)$ is the renewal density.[1]

The predicted turnover rates are highly dependent on the age of the ten program system (see Fig. 4). The rates reduce dramatically after three months and are rapidly converging to a steady state value after one year. Interestingly enough, the same overall conclusions are reached as with the renewal model; the turnover rates for both NAB-JOBS and regular hires are nearly identical.

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[1] Since $f(t) = \lambda e^{-\lambda t}$ is the CLS density, then

$$h(T) = f(T) + \int_0^T h(T-t)f(t)dt = \lambda$$ (Bartholomew, 1973; Perry, 1975).

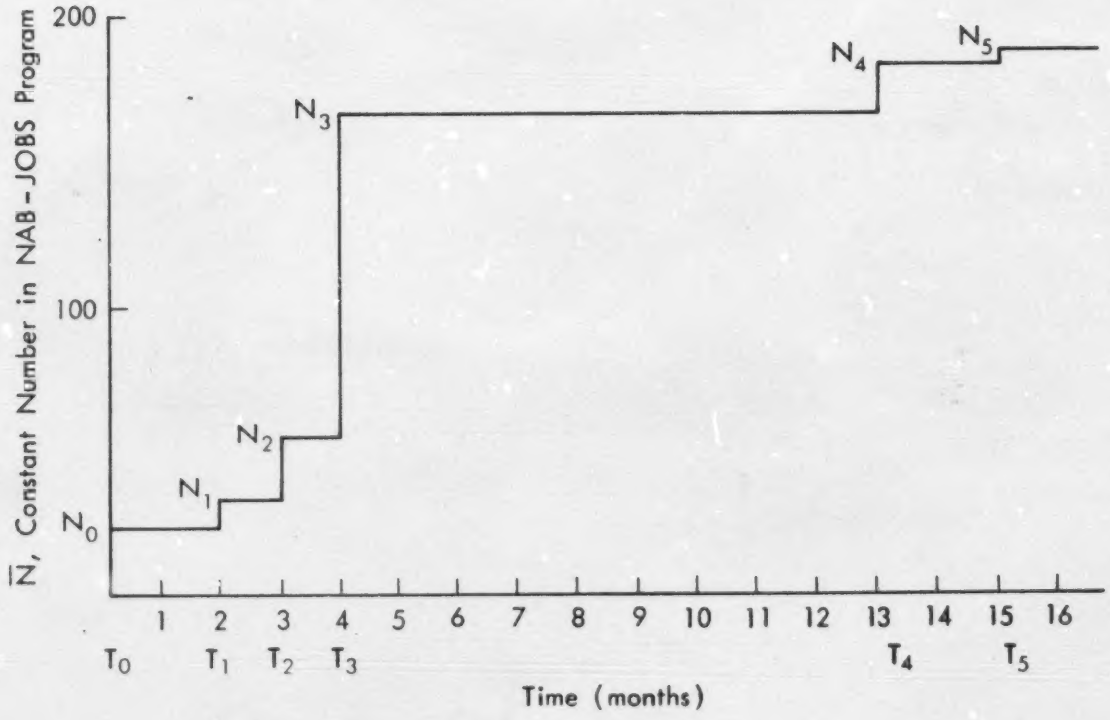

Fig. 3—Growth of NAB-JOBS program

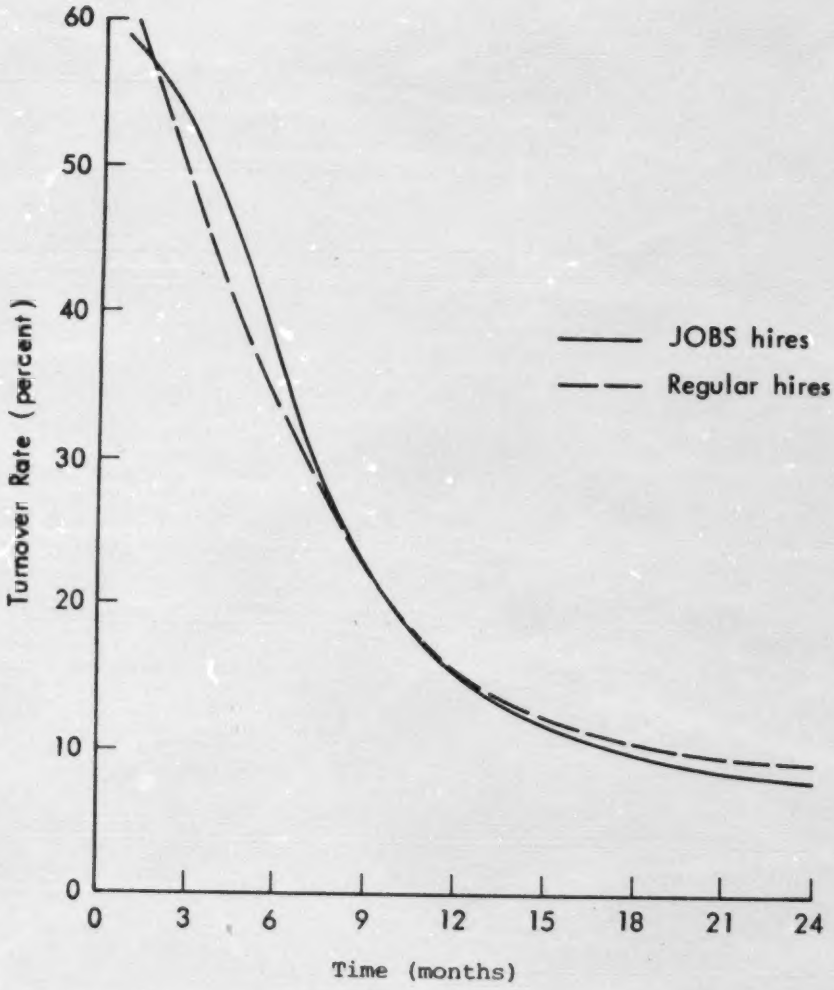

Fig. 4—Predicted turnover rates vs. time

The disastrous relative termination rates quoted by the program's critics must be evaluated by comparing turnover rates of NAB-JOBS hires with those of regular employees hired during the same period in similar jobs. The observations of many personnel managers, shop floor supervisors, and politicians are apparently distorted by prejudice against secondary workers.

IV. A SIMULTANEOUS MODEL OF TURNOVER, RETENTION AND ABSENTEEISM

The preceding discussion focused on termination rates or the group's expected length of service as properties of the system for comparing the stability of the two work forces in the transient and steady state. The central concern is measuring and modeling the individual's propensity to terminate.

Most previous studies have considered absenteeism merely as an analog of turnover and assumed the two processes have identical determinants. Consequently, no attempt had been made to study both withdrawal processes simultaneously. If one assumes a priori that the relationship between absenteeism and turnover is simultaneous (i.e., a contemporaneous feedback effect), then the previous studies using the ordinary least squares estimation procedure will yield biased and inconsistent estimates of the equation's parameters. This condition can result in misleading inferences associated with individual, managerial, and corporate policy variables used to explain these withdrawal processes.

The fundamental hypotheses investigated in the final model of turnover is that there is a simultaneous or structural relationship between the propensity to terminate and absenteeism. Diagramatically this relationship is given as:

Propensity to Terminate ⟷ Absenteeism

Much behavioral research has been reported over the past 10-15 years concerning the factors relating to voluntary turnover and absenteeism by employees (Porter and Steers, 1973). Generally, overall job satisfaction is found to be consistently and inversely related to turnover. This global concept of satisfaction, while important, does not help one

to know why an employee is dissatisfied; nor does it help to determine what must be changed in an effort to retain an individual. The concept of job satisfaction was disaggregated into variables relating to the following factors: (1) organizational and company policies and programs, (2) co-worker and supervisory interaction, (3) other job related variables, and (4) personal or individual variables. These are a group of micro-factors (variables related to the individual, his work environment, and the firm's behavior) that are involved in the decision to withdraw. Excluded from subsequent analysis are potentially significant macro-factors (variables external to the firm or the individual), such as overall economic conditions that probably were not important when the data were collected, and specific job alternatives available to the individual that probably were important.

INTRODUCING SUPERVISORY INTERACTION

All of the preceding discussion was concerned with termination and absenteeism as voluntary withdrawal decisions. There are many empirical difficulties associated with accurately distinguishing between voluntary and involuntary turnover. This inherent ambiguity is further complicated because more than one firm is investigated simultaneously in the cross-sectional sample being studied, firms differ in their classification of termination for reasons of attendance. The most universal reason given by supervisors for firing a JOBS hire was the attendance problem. Therefore, since overall performance of the program participants appears satisfactory and there were no major layoffs during the period under study, then involuntary terminations are also related significantly to the frequency of absenteeism.

There is a consistently inverse relationship between the amount of special supervisory efforts provided program trainees and their attendance, performance, and retention (Davis, et al., 1973). Given the fact that the typical supervisor of the JOBS hires is likely to be their social opposite (the typical supervisor is a white male and over 40) it is easy to believe that there is some question as regards his effectiveness with these new hires. One might argue that increased supervisory attention would only further antagonize the JOBS hire resulting in more absenteeism and a higher propensity to terminate.

Alternatively, the increased supervisory recognition and help could reduce attendance problems and simultaneously decrease the tendency to terminate. Any variable that measures supervisory interaction with the JOBS hires must be the third endogenous variable in the structural model.

EMPIRICAL METHODOLOGY

When voluntary and involuntary terminations are included in the hypothesized model, the complete a priori endogenous structure of the simultaneous model is as given below.

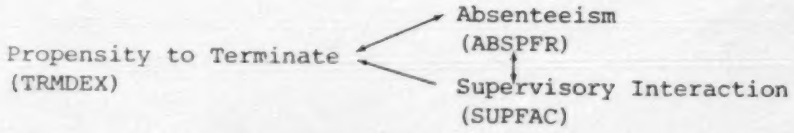

Fig. 5--Complete a priori endogenous structure of the simultaneous model of turnover

Endogenous Variables

The propensity to terminate is measured by an index (TRMDEX) derived in Appendix B. Using reliability theory the index is based on the completed length of service distribution. TRMDEX can be thought of as representing an individual's probability of leaving within one year given he has been employed, say, T weeks.

The remaining two endogenous variables are the percentage of days absent (ABSFER) within the one year period, and the supervisor's time spent counseling JOBS hires (relative to average time spent with regular hires) and other special allowances or techniques provided for the JOBS hires. The primary reason for the selection of these variables is that they were the most reliable measures of employee attendance and supervisory interaction available (see Appendix C).

Exogenous Variables

The significant exogenous variables were determined from groups of variables and indices derived by factor analysis.[1] These variables

[1] Factor analysis is a generic name given to a class of techniques whose purpose consists of data reduction and summarization. See Van de Greer, 1971 for an introductory discussion of the methods.

and indices measure (1) individual characteristics, (2) co-worker interaction or social functionalism, (3) job characteristics, and (4) company policies. The exogenous variables are also listed in Appendix C along with brief definitions.

Linear Structural Equations

The theories that are either directly or indirectly related to absenteeism and turnover are certainly not sufficiently complete (and are too far tentative) to specify any particular functional form for the model. Hence, a linear form was specified for convenience. The linear simultaneous structural system may be expressed by the equations below.[1]

$$\text{TRMDEX} = \sum_{i=0}^{n-2} \pi_i X_i + \pi_{n-1}\text{ABSPFR} + \pi_n \text{SUPFAC} \qquad (4)$$

$$\text{ABSPFR} = \sum_{i=0}^{m-2} \pi_i' X_i + \pi_{m-1}'\text{TRMDEX} + \pi_m'\text{SUPFAC} \qquad (5)$$

$$\text{SUPFAC} = \sum_{i=0}^{k-1} \pi_i'' X_i + \pi_k''\text{ABSPER} \qquad (6)$$

where X_i = ith exogenous variable

π_i, π_i', π_i'' = ith linear parameter

The empirical problem, in the classical sense of hypothesis testing, was to ascertain whether given exogenous or endogenous variables entered a particular equation (structural or reduced forms) and the direction of their effects. If there were sufficient a priori reason to believe that the direction of the effect is known, the empirical question then is to determine whether the estimated parameter for that variable is zero or significantly non-zero in the hypothesized direction. Beginning with the endogenous variables and

[1] The stochastic error term has been omitted.

then proceeding to the exogenous ones, an interactive procedure was followed in which the variable with the smallest t-statistic was removed and the system was re-estimated until, for each structural equation, only those variables whose t-statistics are greater than one in absolute value are included. This admittedly arbitrary criterion for the inclusion of variables corresponds to the almost standard procedure in single equation models of maximizing the adjusted multiple correlation coefficient[1] (Perry, 1975).

ESTIMATED ENDOGENOUS STRUCTURE

The final form of the endogenous structure of the simultaneous equation model is illustrated in Fig. 6. The empirical analysis

Fig. 6--A posteri endogenous structure

supports the fundamental hypothesis that there is an interdependent simultaneous relationship between the propensity to terminate of a JOBS hire and his frequency of absenteeism. Does supervisory interaction with program participants affect these withdrawal problems? The evidence suggests that increased absenteeism is important in determining the amount of time, counseling, or other special allowances provided by supervisors for the trainees; but, the supervisors' efforts seem to have no significant effect on correcting attendance problems of the JOBS hires. The empirical results also indicate that there is no direct relationship between an individual's propensity to terminate and the amount of the supervisor's time and energy provided him. Thus, the

[1] Whatever their meaning and interpretation in a simultaneous equation system, two versions of a multiple correlation coefficient (R_1^2, R_2^2) are reported in Appendix Tables C.1, C.2, and C.3. First, R_1^2 is based upon the observed values of a given endogenous variable and the other, R_2^2, upon the predicted values of the endogenous variables which are utilized in the second stage structural estimation. See Johnston, 1972 for an introductory discussion of simultaneous modeling and the 2SLS estimation procedure.

supervisory forces' efforts appear inconsequential as regards the withdrawal of JOBS hires. (See Appendix Tables C.1, C.2, and C.3.)

Supervisory limitations in integrating the secondary workers into the primary labor market are understandable. The typical supervisor was white, male, over 40, and a long-time employee of the company. He had worked his way up through the ranks in the traditional manner. In physical characteristics, attitudes, and possibly values, he must appear the social antithesis of the typical JOBS hires. Given this situation, the creation of a more productive interrelationship might involve an ambitious re-education program for line supervisors. The firms visited in this sample had little more than a nominal orientation course for them. Shop floor comments and the empirical analysis suggests that JOBS workers did represent a "new work force." This finding brings out the unprecedented shift in the supervisors' situation. In overseeing this new work force, the regular supervisory force, even if possibly well-intentioned and willing to take time, may be unaware of the real problems and thus incapable in the short run of performing its role with JOBS hires.

THE EFFECTS OF THE EXOGENOUS VARIABLES[1]

The simultaneous model is identifiable as regards the usual rank order conditions. The primary exogenous variables in the termination and absenteeism structural equations are given in eq. 7. The study supports the assumption that turnover and attendance do not have identical determinants.

$$\begin{aligned} \text{Termination} &= f\ (\text{company policy variables}) \\ \text{Absenteeism} &= f\ (\text{individual variables}) \end{aligned} \qquad (7)$$

Specific policy implications of the exogenous variables warrant stating. These findings point out both the importance of recognizing a simultaneous equation system (i.e., using a structural model for policy analysis) and the ease of being mislead when one does not recognize or rely on that structure for policy inferences.

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[1] See Appendix and Tables C.1 and C.2 for the estimated simultaneous equations.

Individual Variables

The fact that the individual variables sex, age, and race entered significantly in the reduced form of the termination equation but were not significant enough to enter the structural form provides important insight into how one might make an inappropriate inference on an emotion-laden issue. The reduced and structural forms of the turnover equation, if viewed separately, lead to contrary conclusions. The reduced form implies direct racial discrimination or that blacks and males are inherently less stable workers; the structural form denies both. The evidence suggests that absenteeism is the variable through which the implied discrimination or "inherent" instability of these secondary workers affects turnover. There may be a more subtle problem associated with absenteeism; it may reflect a deeper dissatisfaction by the JOBS workers than merely difficulties in getting to work.

One can only speculate as to why these and other demographics, which are to some extent a measure of the degree an individual is disadvantaged, dominate the structural form of the absenteeism equation. Many observers have commented on the difficulties the disadvantaged experience in getting to work, which is primarily a result of their overall socio-economic environment and where they reside (Padfield and Williams, 1973; Schlensky, 1970).

Most of the primary jobs opened up to the JOBS hires were not very inspiring; 70 percent were unskilled manual laborer jobs--janitors, sweepers, porters, etc. After unskilled manual labor, the next largest category was low-skilled or semi-skilled factory work and office clerks. Only one firm placed JOBS hires in a regular apprenticeship program.

There is a positive and highly significant relationship between increased job performance (QUAL) and a higher propensity to terminate. This result is not too suprising for during the data collection the following remarks were overheard, "He was an eager beaver at first but now he has adjusted to the way things are done here." In the questionnaires, many JOBS hires indicated their dissatisfaction with the training program, the menial nature of the work, and the lack of promotional opportunities. These comments are consistent with complaints of many disadvantaged workers centering on the "character of available jobs." The questionnaires, however, were by no means unanimous.

Semi-skilled and while collar workers had significantly lower propensities to terminate. One can only speculate that white collar jobs were perceived to be less demeaning and thus more desirable. Low-skilled or semi-skilled primary jobs, rather than unskilled or high skilled jobs, probably were not too demeaning or demanding for the average worker associated with the program. Coupled with the fact that the JOBS hires' skills and performance did not differ significantly from those of regular hires, these findings are not altogether surprising. In many firms short-term peaks in the labor demand are in fact shifted to the secondary market on a temporary basis. Hence many members of the secondary labor force have performed these semi-skilled jobs previously without enjoying the full employment rights and benefits that would have accrued with tenure and seniority privileges.

All evidence suggests that attendance problems are strong indications of an unsatisfactory meshing of the trainee and his work environment. Thus, the employee's decisions to terminate or be absent are rationally (as well as empirically) distinguishable on several important dimensions.

First, the negative consequences associated with absenteeism (unless the absence precipitates involuntary terminations) are much less severe than with termination. For example, sick leave policies permit employees to be absent without loss of pay. Next, absenteeism is more likely than termination to be a spontaneous and relatively easy decision to make. Termination is likely to be considered more carefully, especially as a function of tenure. Finally, absenteeism may be a surrogate for turnover, particularly since many secondary workers may not perceive alternative employment to be readily available. Consequently, absenteeism allows one to withdraw temporarily from an unsatisfactory situation without the loss of the total benefits of employment. However, termination is a final decision to withdraw completely from the employment relationship.

Company Variables

The corporate exogenous variables clearly dominate the structural form of the termination equation. The variable most significant in reducing the propensity to terminate is a factor construct (PRIMPF) that can be interpreted as an indication of the visibility or effect of the program. It is very dependent on the size of the program and the percentage of blacks employed normally by the firm. The reduction in the propensity to terminate can be interpreted as indicating the strength of the commitment by the top management in a firm that already has a history of less discrimination in its employment practices. This policy has the most important influence on the retention of JOBS hires. This interpretation is reinforced by the fact that the other variables in this index are motivational screening, granting special treatment, and increased disfavor toward the program by supervisors and co-workers after it has been in operation for a period of time. All of the above imply a strong and favorable commitment by the firm's top management toward the basic objectives of the NAB-JOBS program. The program impact factor and the influences it represents clearly decrease the tendency for voluntary, involuntary, and early terminations.

The next most significant variable in the structural form of the termination equation is a program investment factor (PRINVF), the index that reflects the per capita resources allocated to a firm's NAB-JOBS program. This factor construct includes variables indicating whether the company had a government contract, the percentage of blacks in the program, the length of the training program, whether transportation was paid, amount of outside-the-plant involvement of program personnel on behalf of the trainees, and the degree of screening according to applicant's ability and previous work history. All of these factors are indications of how much emphasis top management placed upon the program and whether the firm had a government contract.

The company variable (PRIMPF) that is most significant in contributing to the decreased propensity to terminate also contributes weakly to increased absenteeism. One can only speculate on the reasons for this result; but any list of possibilities would include that the influence of company policy upon lowering terminations reflects, in

part, the top management's commitment to relaxed standards for involuntary terminations as a result of attendance in the program. This reasoning implies that there may not be an increase in the reliability of the JOBS hires. These results suggest that the JOBS hires may have perceived and taken advantage of the lowered standards by being absent more often.

V. CONCLUDING COMMENTS

Solely in terms of significance, the company policy variables are the most important determinants of the propensity to terminate. On the basis of this equation alone, one may be tempted to conclude that the policies of the companies and their programs are the important ingredients in changing the secondary market worker into a stable member of the mainstream of our economy. This socially desirable change would in part be accomplished by helping these workers redefine their status in the labor market as regular hires. Unfortunately, the absenteeism equation suggests that such a socially desirable conclusion may not be warranted. First, these company policies generally lack significance in the absenteeism equation and have contradictory signs in alternative hypotheses. Next, the feedback effect of the propensity to terminate on the frequency of absenteeism is not very strong. Finally, the regular supervisory force apparently lacks effectiveness with this "new work force." These findings imply that the reduction in the tendency to terminate may be only a reflection of some firms' commitment and not an indication that these secondary workers have undergone a complete social transformation. Thus, one is left with the discouraging possibility that these disadvantaged workers are not on the verge of being integrated into the primary labor market.

The firms' implied commitment may be a significant outcome of our national manpower policy if it helped generate a permanent change in some of their hiring practices. Historical and recent evidence suggests that otherwise most of these individuals would not have been considered for permanent employment in the primary labor market. However, in the short run, the social transformation of the secondary labor force cannot be accomplished if firms provide only the lowest-level entry jobs.

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Appendix A

RESULTS OF THE LOGISTIC MODEL

The Independent Screening Variables

(1)	SEX	A dummy variable taking 1 for male, 0 for female.
(2)	AGE	Age of worker when hired.
(3)	RACE	A dummy variable taking 1 for white, 0 for black.
(4)	MAR1	A dummy variable taking 1 for married, 0 for unmarried.
(5)	MAR2	A dummy variable taking 1 for divorced or separated, 0 otherwise.
(6)	DEPS	Number of dependents supported by the worker.
(7)	GRAD	Highest school grade completed.
(8)	WKSUN	Number of weeks unemployed in year before hire.
(9)	WELF[a]	A dummy variable taking 1 if the employee was on welfare previous to hire, 0 otherwise.
(10)	CRIM[a]	A dummy variable taking 1 if the individual had a known criminal record when hired, 0 otherwise.
(11)	INCYBH[b]	Estimated income in year before hire.
(12)	DIST	Approximate distance in miles by main roads from home to work when hired.
(13)	PAY1	Initial biweekly salary.

[a] Not applicable to regular hires.

[b] Not known for regular hires.

Table A.1

LOGISTIC MODELS OF TURNOVER FOR THE TOTAL NAB-JOBS AND REGULAR HIRES SAMPLE

Dependent Variable $y_i = \begin{cases} 1 \text{ if terminated (voluntarily or involuntarily)} \\ 0 \text{ if on board} \end{cases}$

(t-statistics in parentheses)

	Total Samples			
	NAB-JOBS Trainees		Regular Hires	
Sample Size	384		165	
Number of Terminations	197 (51%)		46 (28%)	
Likelihood Ratio Statistic[a]	531.02		194.60	
	LOGISTIC PARAMETERS			
Screening Variables	REG.	BETA	REG.	BETA
Intercept	1.488		0.488	
1. SEX	0.439 (3.01)[b]	0.186	-0.158 (-1.18)	-0.068
2. AGE	-0.012 (-2.26)[b]	-0.101	0.015 (2.47)[b]	0.134
3. RACE	-0.340 (-3.29)[b]	-0.138	-0.917 (-7.73)[b]	-0.350
4. MAR1	-0.635 (-5.76)[b]	-0.137	0.034 (0.27)	0.016
5. MAR2	-0.311 (-2.28)[b]	-0.114	0.439 (2.07)[b]	0.100
6. DEPS	0.023 (0.87)	0.049	-0.053 (-1.09)	-0.070
7. GRAD	-0.034 (-1.06)	-0.047	0.055 (1.24)	0.062
8. WKSUN	0.008 (3.48)[b]	0.150	-0.013 (-4.00)[b]	-0.196
9. WELF	-0.608 (-6.86)[b]	-0.301		
10. CRIM	0.020 (0.18)	0.008		
11. INCYBH	0.00004 (0.94)	0.043		
12. DIST	-0.003 (-2.36)[b]	-0.100	0.0001 (0.13)	0.006
13. PAY1	-0.001 (-1.13)	-0.069	-0.004 (-3.33)[b]	-0.200

[a] Likelihood ratio statistic = $2\text{Ln}(\lambda) = \chi^2(p-1)$; $p_1 = 14$ $p_2 = 11$

where: $\lambda = \dfrac{\Pi_i \bar{y}^{y_i} (1-\bar{y})^{1-y_i}}{\Pi_i p_i^{y_i} (1-p_i)^{1-y_i}}$

H_0: $E(y_i = 1 | X_i) = \bar{y}$

H_1: $E(y_i = 1 | X_i) = p_i$

Reject H_0 at the 1 percent level of significance

λ = likelihood ratio.

[b] Significantly different from zero at the 5 percent level.

Appendix B

MEASURING THE PROPENSITY TO TERMINATE

Derivation of the Propensity to Terminate Based on the Exponential Completed Length of Service (CLS) Distribution

In the derivation that follows the variable of interest is length of service in the NAB-JOBS program. The terminology and notation given below will be used.

$f(T)$ = completed length of service (CLS) probability density function

$f(T)dT$ = the proportion of the employees who leave in the time interval $(T, T + dT)$.

$F(T)$ = CLS distribution function associated with $f(T)$,

$$F(T) = \int_0^T f(t)dt \qquad dt = \text{unit interval of time}$$

$G(T)$ = the "survivor function," which is the complement of $F(T)$; i.e., $G(T) = 1 - F(T)$ is the proportion of employees leaving after T weeks of service.

$\alpha(T)$ = loss intensity (i.e., the hazard function in reliability theory), which will be termed the "Force of Separation" or "Group Propensity to Terminate."

The expression for $\alpha(T)$ is given by

$$\alpha(T) = \frac{f(T)}{G(T)} = \frac{f(T)}{1-F(T)} \tag{B.1}$$

where by definition

$$\Pr\{\text{loss in } (T, T+dT) \mid \text{survival to } T\} \equiv \alpha(T)dT$$

Thus, $\alpha(T)dT$ is the proportion of employees who have not left prior to T weeks but who leave in the time interval $(T, T + dT)$.

Since it was concluded that the exponential model (i.e., $f(T) = \lambda e^{-\lambda T}$) adequately represents the observed termination data for the NAB-JOBS sample, $\alpha(T)$ is given by[1]

$$\alpha(T) = \lambda \tag{B.2}$$

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[1] $F(T) = \int_0^T \lambda e^{-\lambda t} dt = 1-e^{-\lambda T}$

$$\alpha(T) = \frac{\lambda e^{-\lambda T}}{1-(1-e^{-\lambda T})} = \frac{\lambda e^{-\lambda T}}{e^{-\lambda T}} = \lambda$$

Thus, the propensity of termination for a unit interval of time (i.e., one week in the NAB-JOBS sample) is equal to the constant, λ.

Derivation of an Index (TRMDEX) to Measure an Individual's Propensity to Terminate Within the First Year of Employment

An individual's propensity to terminate in the NAB-JOBS program (including those on board) can be measured by an index (using the group propensity to terminate $\alpha(T)$) based on the individual's conditional probability of turnover within the first year[1] of employment given he has been employed to time T. The derivation is as follows.

letting τ = the event of a loss

$$\bar{\alpha}(T)\,|\,\text{one year} = \frac{P\{T<\tau<52 \text{ weeks}\}}{1-F(T)} \tag{B.3}$$

where

$$P\{T<\tau<52 \text{ weeks}\} = \int_{T}^{52} \lambda e^{-\lambda t} dt$$

Therefore, eq. (B.3) may be expressed as

$$\bar{\alpha}(T)\,|\,\text{one year} = 1 - \frac{e^{\lambda T}}{e^{52\lambda}} \tag{B.4}$$

The proposed index, TRMDEX, which measures the individual's propensity to terminate within one year given he has a length of service equal to T, is a function of $\bar{\alpha}(T)$. Analytically this relationship for TRMDEX is given by

$$\text{TRMDEX} = \begin{cases} \Psi\ (\bar{\alpha}) & ;\ T \leq 52 \text{ weeks} \\ 0 & ;\ T > 52 \text{ weeks} \end{cases} \tag{B.5}$$

Thus, for the NAB-JOBS sample it is possible to construct a measure of an unobservable variable, an individual's propensity to terminate.

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[1] The empirical rationale of using the first year as the base employment period is the following (Perry, 1975):

(1) Empirical evidence consistently established the dependence of the number of terminations on the length of service; in particular, 95 percent of all terminations are within the first year in the NAB-JOBS sample being studied.

(2) The significance of the individual screening variables used to estimate the probability of turnover change as a function of the completed length of service of the work force. Fundamental changes occur in the model after one year's service.

(3) If one views terminations as the outcome of a stochastic process, turnover rates can be highly dependent on the age of the organization or the tenure of its personnel. The stochastic models of the expanding NAB-JOBS program indicate that after one year the turnover rate is rapidly converging to a steady state value.

Appendix C

RESULTS OF SIMULTANEOUS MODELS[a]

Endogenous Variables

(1) TRMDEX — The index that measures the individual's propensity to terminate was derived in Appendix B based on the conditional probability of termination in the first year. The index was scaled by a factor of 1000.

(2) ABSPER — The percentage of working days absent in the first year of employment, derived from payroll or personnel department records. This percentage is scaled by a factor of 100.

(3) SUPFAC — The supervisory interaction factor is the sum of three variables (SUPTMF, SUPHLP, SUPSPC)

- SUPTMF — A factor construct measuring amount of the supervisor's time the individual requires relative to other workers.
- SUPHLP — A dummy variable marking the presence of special extra-job facilities or help provided by the supervisor. The major item here is counseling.
- SUPSPC — A dummy variable marking the presence of special techniques as related to job performance by the supervisor for JOBS workers and not used for other workers. This reflects special supervisory attention, allowances, and training.

Exogenous Variables

Personal Variables

(1) SEX — A dummy variable taking 1 for male, 0 for female.

(2) AGE — Age of worker when hired.

(3) RACE — A dummy variable taking 1 for white, 0 for black.

(4) MAR1 — A dummy variable taking 1 for married, 0 for unmarried.

(5) MAR2 — A dummy variable taking 1 for divorced for separated, 0 otherwise.

(6) DEPS — Number of dependents supported by worker.

(7) GRAD — Highest school grade completed.

(8) WKSUN — Number of weeks unemployed in year before hire.

(9) WELF — A dummy variable taking 1 if the employee was on welfare previous to hire, 0 otherwise.

(10) INCYBH — Estimated income in year before hire.

(11) DIST — Approximate distance in miles by main roads from home to work when hired.

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[a] All results are for NAB-JOBS hires only.

(12) PERFRF — A normalized performance factor expressed as deviations about its mean. This factor was constructed from the detailed scaled estimates of supervisors on the worker's relative work speed, quality, attentiveness, motivation, and knowledge of the job. This index is, of course, highly subjective and is explicitly rated relative to other workers under the supervisor's jurisdiction.

(13) QUAL — A one-to-five scaled variable of worker performance, where three is average and five is excellent with respect to the company's work force. Individual ratings were derived from personnel records where available and were scored and normalized by the investigators.

(14) PRM — Number of promotions and upgradings attained by the individual in the first year. This variable can also be considered a company variable or job characteristic.

(15) PAYING — Percentage pay increase achieved by the worker during the first year. This variable can also be considered a company variable or job characteristic.

Co-Worker Interaction Variable

(16) SOCFNF — A factor construct, normalized about its mean, measuring individual social functionalism. The index is based on supervisor ratings of the worker's ability to enter into productive social interactions with his co-workers and supervisors. These ratings are again measured relative to co-workers.

Job Variables

(17) COLLAR — A dummy variable taking 1 if hired for white-collar job, 0 otherwise.

(18) LOSKIL — A dummy variable taking 1 if hired for low-skilled job, 0 otherwise.

Company Variables

(19) PRINVF — Program investment factor reflecting the amount of resources per individual the company puts into its training program. This factor normalized about its mean is heavily loaded by seven variables: (1) whether the company had a government contract, (2) percentage of blacks in the program, (3) length of the training program, (4) whether transportation was paid, (5) amount of outside-the-plant involvement undertaken by the personnel department on behalf of the JOBS workers, (6) degree of screening of the applicants' abilities, and (7) previous work history.

(20)	PRIMPF	Program impact factor normalized about its mean, measuring the visibility of the program within the firm. This factor loads heavily on six variables (1) the number of JOB hires, (2) percentage of blacks in the company, (3) whether motivational considerations were important in selection, (4) whether recruits received special treatment, (5) measurements of the level of favorability of co-workers' and (6) supervisors' attitudes to the program after it had been in operation for a period.
(21)	SOCALF	Social alienation factor normalized about its mean, a linear combination that reflects the initial disfavor toward the JOBS program held by (1) co-workers and (2) supervisors.

Table C.1

PROPENSITY TO TERMINATE EQUATIONS[a]
(TRMDEX)
(t-statistics in parentheses)

Variable Name	Reduced Form (OLS)	Structural Form (2SLS)	Structural Form (OLS)
1. CONSTANT	311.18 (2.41)	96.25 (0.75)	318.60 (3.36)[b]
2. SEX	136.97 (2.21)		
3. AGE	-3.12 (-1.31)		
4. RACE	-83.05 (-1.77)		
5. WKSUN	2.59 (2.54)	1.30 (1.18)	1.90 (1.88)
6. INCYBH	0.002 (0.08)		
7. MAR1	-103.12 (-2.20)	-108.51 (-2.51)[c]	-116.11 (-2.48)
8. MAR2	-95.06 (-1.60)	-186.32 (-2.93)[c]	-152.97 (-2.63)
9. DEPS	12.09 (1.02)	16.75 (1.53)	12.96 (1.28)
10. PERFRF	-1.36 (-0.36)		
11. QUAL	46.63 (1.71)	64.48 (2.18)[c]	36.47 (1.41)[b]
12. PRM	-89.10 (-2.18)	-110.08 (-2.51)[c]	-115.25 (-2.81)
13. PAYINC	-6.08 (-3.81)	-3.54 (-1.97)[c]	-4.77 (-2.94)
14. SOCFNF	-7.92 (-1.84)		
15. COLLAR	-209.60 (-2.65)	-246.11 (-3.24)[c]	-238.09 (-3.37)
16. LOSKIL	-140.01 (-2.40)	-119.82 (-1.95)	-140.17 (-2.47)[b]
17. PRINVF	-33.89 (-5.44)	-31.55 (-5.07)[c]	-25.86 (-4.71)
18. PRIMPF	-38.53 (-6.53)	-42.50 (-6.78)[c]	-38.83 (-6.81)
19. SOCALF	-64.82 (-5.45)	-59.18 (-4.86)[c]	-64.42 (-5.76)
20. ABSPER		18.57 (3.92)[c]	6.36 (3.23)
R_1^2 (observed value)	0.408	0.437	0.388
R_2^2 (2SLS est.)	(N.A.)	0.405	(N.A.)

[a]The Brookings (2SLS) Computer Program on the IBM 360 was used for all estimations in Tables C.1, C.2, and C.3.

[b]OLS bias.

[c]Significantly different from zero at the 5 percent level.

Table C.2

ABSENTEEISM EQUATIONS
(ABSPER)
(t-statistics in parentheses)

Variable Name	Reduced Form (OLS)	Structural Form (2SLS)	Structural Form (OLS)
1. CONSTANT	10.91 (2.92)	7.24 (2.87)[a]	7.50 (3.14)
2. SEX	4.60 (2.57)	4.13 (3.24)[a]	4.17 (3.30)
3. AGE	-10.86 (-1.58)	-0.09 (-1.44)	-0.10 (-1.46)
4. RACE	-4.68 (-3.44)	-4.34 (-3.33)[a]	-4.33 (-3.32)
5. WKSUN	0.06 (1.89)	0.04 (1.46)	0.05 (1.57)
6. INCYBH	0.0007 (1.06)	0.0008 (1.20)	0.0008 (1.20)
7. MAR1	0.02 (0.01)		
8. MAR2	4.29 (2.50)	4.37 (3.06)[a]	4.32 (3.05)
9. DEPS	-0.40 (-1.17)	-0.43 (-1.38)	-0.44 (-1.41)
10. PERFRF	-0.12 (-1.14)	-0.14 (-1.37)	-0.14 (-1.35)
11. QUAL	-0.63 (-0.81)		
12. PRM	1.17 (0.99)	1.48 (1.33)	1.49 (1.33)
13. PAYINC	-0.13 (-2.89)	-0.10 (-2.17)[a]	-0.10 (-2.33)
14. SOCFNF	-0.46 (-3.70)	-0.44 (-3.57)[a]	-0.45 (-3.65)
15. COLLAR	0.63 (0.27)		
16. LOSKIL	-1.90 (-1.13)		
17. PRINVF	0.005 (0.03)		
18. PRIMPF	0.16 (0.96)	0.25 (1.64)	0.23 (1.69)
19. SOCALF	-0.47 (-1.36)		
20. TRMDEX		0.004 (1.34)	0.003 (2.02)[b]
R_1^2 (observed value)	0.279	0.281	0.228
R_2^2 (2SLS est.)	(N.A.)	0.271	(N.A.)

[a]Significantly different from zero at the 5 percent level.

[b]OLS bias.

Table C.3

SUPERVISORY INTERACTION STRUCTURAL EQUATIONS
(SUPFAC)
(t-statistics in parentheses)

Variable Name	Model I		Model II		Model III	
	2SLS	OLS	2SLS	OLS	2SLS	OLS
1. CONSTANT	3.28 (2.68)[a]	3.41 (2.84)	2.76 (1.85)	3.30 (2.59)[b]	2.17 (1.30)	2.80 (2.08)[b]
2. SEX	-0.66 (-1.47)	-0.50 (-1.34)	-1.34 (-2.65)[a]	-0.53 (-1.38)[b]	-1.72 (-3.26)[a]	-0.82 (-2.04)
3. WELF	-0.61 (-2.34)[a]	-0.60 (-2.31)	-0.46 (-1.50)	-0.52 (-1.95)		
4. MAR1	-0.62 (-2.15)[a]	-0.64 (-2.28)	-0.58 (-1.66)	-0.69 (-2.31)[b]	-0.61 (-1.54)	-0.84 (-2.65)[b]
5. MAR2	-1.27 (-2.99)[a]	-1.15 (-3.06)	-1.77 (-3.60)[a]	-1.24 (-3.11)	-2.12 (-3.96)	-1.56 (-3.69)
6. DIST	-0.007 (-2.11)[a]	-0.007 (-2.12)	-0.008 (-1.87)	-0.008 (-2.16)[b]	-0.008 (-1.58)	-0.008 (-1.95)
7. GRAD	-0.21 (-2.13)[a]	-0.20 (-2.07)	-0.24 (-2.03)[a]	-0.20 (-2.02)	-0.24 (-1.79)	-0.18 (-1.65)
8. PERFRF	-0.04 (-1.51)	-0.05 (-1.83)	-0.07 (-2.17)[a]	-0.13 (-5.87)		
9. PAYING	0.01 (1.28)	0.01 (1.11)	0.03 (2.14)[a]	0.01 (1.33)[b]	0.03 (2.31)[a]	0.02 (1.39)[b]
10. SOCFNF	-0.16 (-3.90)[a]	-0.18 (-5.85)				
11. PRINVF	0.18 (4.80)[a]	0.18 (4.79)	0.20 (4.34)[a]	0.18 (4.58)	0.20 (4.12)[a]	0.20 (5.05)
12. PRIMPF	-0.04 (-1.31)	-0.04 (-1.18)				
13. ABSPER	0.06 (1.12)	0.03 (1.79)	0.02 (4.06)[a]	0.05 (3.11)	0.25 (6.21)[a]	0.07 (4.84)
R_1^2 (observed value)	0.389	0.378	0.376	0.294	0.370	0.193
R_2^2 (2SLS est.)	0.373	(N.A.)	0.328	(N.A.)	0.304	(N.A.)

[a]Significantly different from zero at the 5 percent level.

[b]OLS bias.